OIPE JC113
MAR 2 5 2004
PATENT & TRADEMARK OFFICE

Certification under 37 CFR 1.10

EF740973335US EXPRESS MAIL mailing number

March 25, 2004 Date of Deposit

I hereby certify that the correspondence identified below is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to: Mail Stop Appeal Brief - Patents, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

Georgann S. Grunebach, Reg.No. 33,179
(Typed name of person mailing correspondence)

Georgann S. Grunebach March 25 2004
(Signature of person mailing correspondence)

Customer Number 020991

PATENT
Docket No. PD-980034

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In Re Application of:

Donald C. D. Chang

Serial No. 09/497,865 Group Art Unit: 3662

Filed: February 4, 2000 Examiner: Issing, Gregory C.

For: AN IMPROVED PHASED ARRAY TERMINAL FOR EQUATORIAL SATELLITE CONSTELLATIONS

Attorney Docket No: PD-980034 (H 1057 PA)

RECEIVED
MAR 3 1 2004
GROUP 3600

BRIEF ON APPEAL

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

The following Appeal Brief is submitted pursuant to the Notice of Appeal filed on February 2, 2004, for the above-identified application.

I. Real Party in Interest

The real party in interest in this matter is Hughes Electronics Corporation of El Segundo, California.

II. Related Appeals and Interferences

There are no other known appeals or interferences which will directly affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

III. Status of the Claims

Claims 1-5 and 7-37 stand rejected in the Final Office Action. There have been no amendments filed subsequent to the final rejection.

IV. Summary of the Invention

The present invention relates generally to a low cost, low profile tracking phased array antenna for use on a commercial satellite terminal that is adapted for use with an equatorial satellite constellation system. Various tracking ground terminals exist, which are directed for use and sale in the consumer market. These antennas are typically configured as multi-beam tracking ground terminals, which include arrays with mechanisms for steering beams, such as phase shifters. These arrays further include integrated mechanisms for simultaneously tracking the pointing directions of these multiple beams. With these systems, each beam has a separate set of electronics associated with each element to process the various signals, including multiple phase shifters and other associated processing circuitry. These systems, therefore, suffer from significant drawbacks. Specifically, these tracking antennas are relatively expensive because of the multiple sets of electronics and are bulky because of the size required to house the electronics.

The present invention has recognized these drawbacks and provides an antenna 10 having a rotating plate 16 for mechanically scanning for wave signals in azimuth. The rotating plate 16 includes a plurality of radiation elements 18 positioned thereon for electronically scanning for wave signals in elevation. Each of

the radiation elements 18 is in communication with *coding circuitry coupling a respective code to the element signals* and apparatus, such as a multiplexer 44, which consolidates the wave signals received at each of the radiation elements to an analog bit stream. Thereafter, the analog bit stream is converted to a digital bit stream by an analog to digital converter 50. The digital bit stream is then transferred to a multiple beamforming device 54 which forms multiple digital beams. The digital beams are converted to information signals such that the antenna 10 can lock onto a second equatorial satellite in the constellation before locking off a first equatorial satellite. A digital receiver 64 is used to determine signal strengths for the coded element signals and to lock onto a strongest signal having a corresponding element, so that the corresponding element can be used for transmission.

V. Issues

The following issues are presented in this response, each of which correspond directly to the Final Office Action, dated October 10, 2003:

Whether Claims 1, 4, 5, 7-9, 11, 13-18, 21-22, and 25-37 are patentable under 35 U.S.C. § 103(a) over *Karlsson et al.* in view of either one of *Chiba et al.*, *Chang* and *Aoki*.

Whether claims 2, 3, 10, 12, 19, 20, and 23-24 are patentable under 35 U.S.C. § 103(a) over the combined prior art above as applied to the claims set forth above and further in view of *Ajioka* and *Barrett et al.*

VI. Grouping of Claims

The rejected claims have been grouped together in each of their rejections. The Appellant states, however, that each of the rejected claims stands on its own recitation and is separately patentable for the reasons set forth in detail below.

VII. Argument

A. CLAIMS 1, 4, 5, 7-9, 11, 13-18, 21-22, AND 25-37 STAND REJECTED UNDER 35 U.S.C. § 103(A) OVER *KARLSSON ET AL.* IN VIEW OF EITHER ONE OF *CHIBA ET AL.*, *CHANG* AND *AOKI.*

The independent claims have similar limitations and will therefore be argued together. The claims are directed to an antenna for communication with a satellite/satellite constellation. The antenna comprises a rotating plate for mechanically scanning for wave signals in azimuth, a plurality of radiation elements positioned on the rotating plate for receiving incoming waves, *coding circuitry coupling a respective code to the element signals* and apparatus, such as a multiplexer, for consolidating all the coded element signals received at each of the plurality of radiation elements and outputting an analog bit stream. Circuitry is also included for forming multiple digital beams from the analog bit stream. The element signals are coded according to their respective locations and the strongest signal determined. The location corresponding to the strongest signal is then used to transmit the transmit beam back to the satellite. This is set forth by the inclusion of the coding circuitry mentioned above and the digital receiver that determines signal strengths for the coded element signal and locks onto a strongest signal having a corresponding element. The locked onto corresponding element can then be used for transmission. Support for the retrodirective portion is found in the specification beginning on page 13, line 14 through page 16, line 5.

As the Examiner recognized, *Karlsson et al.* fails to teach the use of a digital beamformer. (February 1, 2002 Office Action p. 2) This reference also fails to teach at least the following (1) a multiplexer associated with each of the plurality of radiation elements, (2) an analog to digital converter and (3) *coding circuitry coupling*

a respective code to the element signals. The reference also fail to teach or suggest the retrodirective aspect of the claims. That is, none of the references codes element signals so that the direction of the strongest signal is determined and the element with the strongest signal which in turn correspond to the waveguides illustrated in Fig. 2 is used when transmitting a beam. Also, *Karlsson et al.* fails to disclose any details about digital beamforming.

The *Chiba* reference also fails to teach retrodirectivity. No teaching or suggestion is provided for the retrodirective function. That is, no coding is performed on the system to determine the strongest signal direction. The *Chiba* reference is directed to a digital beamforming system. No teaching or suggestion has been found in this reference for the retrodirectivity described above.

The *Chang* reference, on the other hand, teaches a digital beamforming technique using temporary noise injection. In the *Chang* reference coding is provided for each of the signals. The signals are combined together in combiner 180 and provided to two analog-to-digital converters after which decoding according to the codes is performed. However, *Chang* does not teach or suggest is the use of coding for retrodirectivity. That is, the element having the strongest signal is not determined so that a transmitting beam may be transmitted using the same element. Therefore, because none of the references teach or suggest determining the strongest signal and transmitting the beam using the element corresponding to the strongest signal as identified by the element from which the signal comes using the coding circuitry, Appellants respectfully request the Board to reverse the Examiner's rejections.

The *Aoki* reference is directed to an antenna system that is retrodirective. The retrodirectivity receives radio waves and determines their direction. The same

elements are used to direct the signal back in the same direction. Fast Fourier transforms are used to sense the direction. The *Aoki* reference appears to be a fixed type of antenna and not a rotating type antenna. The retrodirectivity is completely electronically controlled. No teaching or suggestion is provided in the *Aoki* reference for the use in combination with a rotating plate and radiation elements that are positioned on the rotating plate. The *Aoki* reference also fails to teach or suggest determining a strongest signal from an element and locking on to the strongest signal having a corresponding element, so that the corresponding element can be used for transmission. That is, the *Aoki* reference appears to teach using each of the elements to determine the direction of the incoming signal and transmits the transmitted signals using the corresponding elements. The *Aoki* reference also fails to teach the coding circuitry.

Because the *Chang* reference and the *Aoki* reference both fail to teach locking onto a strongest signal having a corresponding element so that the corresponding element can be used for transmission, Appellants respectfully request the Board to reverse the Examiner's rejection.

Claim 4 is also believed to be independently patentable since claim 4 requires that the circuitry for forming multiple digital beams does so through FFT techniques. The cited references do not teach or suggest this in association with the recitations of claim 1.

Claim 5 is also believed to be independently patentable since claim 5 requires that the antenna may be utilized on a mobile vehicle. The cited references do not teach or suggest this in association with the recitations of claim 1.

Claim 7 is an independent claim that is similar to claim 1 in that coding circuitry is recited. Appellants believe claim 7 is allowable for the same reasons set forth with respect to claim 1. Claim 7 is believed to be independently patentable.

Claim 8 is also believed to be independently patentable since claim 8 further requires that the device for forming multiple digital beam forms utilize a FFT technique. The cited references do not teach or suggest this in association with the recitations of claim 7.

Claim 9 is also believed to be independently patentable since claim 9 requires that the antenna transmit the multiple digital beams to a plurality of satellites in the equatorial satellite constellation. The cited references do not teach or suggest this in association with the recitations of claim 7.

Claim 11 is also believed to be independently patentable since claim 11 requires that the rotating plate is generally circular in shape. The cited references do not teach or suggest this in association with the recitations of claim 7.

Claim 13 is an independent claim directed to a method of forming multiple beams. Claim 13 is believed to be independently patentable. Claim 13 also recited "coding the respective element signals." Appellants believe claim 13 is allowable for the reasons set forth with respect to claim 1.

Claim 14 is also believed to be independently patentable since claim 14 further requires converting the single analog signal to a digital bit stream and forming multiple digital beams from the digital bit stream. The cited references do not teach or suggest this in association with the recitations of claim 13.

Claim 15 is also believed to be independently patentable since claim 15 further requires utilizing FFT techniques to form the multiple digital beams to provide

for satellite retrodirectivity. The cited references do not teach or suggest this in association with the recitations of claim 14.

Claim 16 is also believed to be independently patentable since claim 16 further requires processing the multiple digital beams prior to transmitting. The cited references do not teach or suggest this in association with the recitations of claim 14.

Claim 17 is also believed to be independently patentable since claim 17 requires that the plurality of radiation elements electronically scan for the wave signals in elevation. The cited references do not teach or suggest this in association with the recitations of claim 14.

Claim 18 is also believed to be independently patentable since claim 18 requires that the antenna is comprised of a generally circular plate that rotates for scanning mechanically for the wave signals in azimuth. The cited references do not teach or suggest this in association with the recitations of claim 17.

Claim 22 is also believed to be independently patentable since claim 22 further requires a converter for converting the first bit stream from an analog bit stream to a digital bit stream. The cited references do not teach or suggest this in association with the recitations of claim 21.

Claim 25 is also believed to be independently patentable since claim 25 requires that the antenna be utilized on a mobile vehicle. The cited references do not teach or suggest this in association with the recitations of claim 21.

Claim 26 is also believed to be independently patentable since claim 26 requires that the apparatus for consolidating the wave signals is a multiplexer. The cited references do not teach or suggest this in association with the recitations of claim 21.

Claim 27 is also believed to be independently patentable since claim 27 requires that the multiplexer is a code division multiplexer. The cited references do not teach or suggest this in association with the recitations of claim 26.

Claim 28 is also believed to be independently patentable since claim 28 requires that the antenna is configured with a low profile. The cited references do not teach or suggest this in association with the recitations of claim 21.

Claim 29 is also believed to be independently patentable since claim 29 requires that antenna is in communication with a commercial satellite terminal. The cited references do not teach or suggest this in association with the recitations of claim 21.

Claim 31 is also believed to be independently patentable since claim 31 further requires mechanically scanning a field of view for the wave signals in azimuth. The cited references do not teach or suggest this in association with the recitations of claim 30.

Claim 32 is also believed to be independently patentable since claim 32 further requires electronically scanning the field of view for the wave signals in elevation. The cited references do not teach or suggest this in association with the recitations of claim 31.

Claim 33 is also believed to be independently patentable since claim 33 further requires converting the single signal to a digital bit stream and forming multiple digital beam forms from the digital bit stream. The cited references do not teach or suggest this in association with the recitations of claim 30.

Claim 34 is also believed to be independently patentable since claim 34 further requires utilizing FFT techniques to form the multiple digital beam forms to

provide for satellite retrodirectivity. The cited references do not teach or suggest this in association with the recitations of claim 33.

Claim 35 is also believed to be independently patentable since claim 35 further requires providing seamless handover from one satellite to another without interruption. The cited references do not teach or suggest this in association with the recitations of claim 31.

Claim 36 is also believed to be independently patentable since claim 36 further requires monitoring signal strength from adjacent received individual wave signals in order to track other satellites in the equatorial satellite constellation. The cited references do not teach or suggest this in association with the recitations of claim 31.

B. THE REJECTION OF CLAIMS 2, 3, 10, 12, 19, 20, and 23-24 UNDER 35 U.S.C. § 103(a)

Claims 2, 3, 10, 12, 19, 20, and 23-24 stand finally rejected under 35 U.S.C. §103(a) as obvious over the combined prior art set forth above as applied to the claims set forth above and further in view of *Ajioka* and *Barrett et al.* Claims 2, 3, 10, 12, 19, 20, and 23-24 are dependent claims, which depend from a respective one of the independent claims set forth above. Thus, the argument set forth above in connection with any claim from which one of these claims depends applies equally to the stated claims.

The *Ajioka* reference teaches the use of dual polarized slot elements in a separated waveguide cavity. No teaching or suggestion is found for the missing elements of the independent claims described above. Namely, *Ajioka* does not teach beamforming on the retrodirective aspects of the claims sand the use of coding circuitry therefor.

The *Barrett* reference teaches the use of a waveguide having a tracking mechanism, particularly in Col. 10, lines 32-50. The *Barrett* reference provides separate steering arrays in Col. 12, line 55-Col. 3, line 22. This adds further expense to such a system. No teaching or suggestion is provided for the retrodirectivity features and the coding circuitry described above with respect to the independent claims.

Claim 2 is also believed to be independently patentable since claim 2 requires that the plurality of radiation elements are parallel cross-slotted waveguides. The cited references do not teach or suggest this in association with the recitations of claim 1.

Claim 3 is also believed to be independently patentable since claim 3 requires that the plurality of radiation elements include a slotted septum therein. The cited references do not teach or suggest this in association with the recitations of claim 2.

Claim 10 is also believed to be independently patentable since claim 10 requires that the plurality of radiation elements are interdigitally spaced slotted wave guides. The cited references do not teach or suggest this in association with the recitations of claim 8.

Claim 12 is also believed to be independently patentable since claim 12 requires that the plurality of radiation elements include a slotted septum therein. The cited references do not teach or suggest this in association with the recitations of claim 11.

Claim 19 is also believed to be independently patentable since claim 19 further requires that the plurality of radiation elements are cross-slotted waveguides.

The cited references do not teach or suggest this in association with the recitations of claim 18.

Claim 20 is also believed to be independently patentable since claim 20 requires that the plurality of cross-slotted waveguides are parallel and interdigitally spaced with respect to each other. The cited references do not teach or suggest this in association with the recitations of claim 19.

Claim 23 is also believed to be independently patentable since claim 23 requires that each of the plurality of elongated radiation elements are cross-slotted waveguides, which are aligned parallel to one another on the antenna. The cited references do not teach or suggest this in association with the recitations of claim 21.

Claim 24 is also believed to be independently patentable since claim 24 requires that each of the plurality of radiation elements include a slotted septum therein. The cited references do not teach or suggest this in association with the recitations of claim 23.

VIII. Appendix

A copy of each of the claims involved in this appeal, namely claims 1-5 and 7-37, is attached hereto as Appendix A.

IX. Conclusion

For the foregoing reasons, Appellants respectfully request that the Board direct the Examiner in charge of this examination to withdraw his rejections and pass this case to issuance.

Respectfully submitted,

Georgann S. Grunebach
Registration No. 33,179

Attorney for Appellant(s)

Date: March 25, 2004

Hughes Electronics Corporation
2250 East Imperial Highway
El Segundo, CA 90245
(310) 964-4615

APPENDIX A

1. An antenna for communication with a satellite, the antenna being for use on a satellite terminal, comprising:

a rotating plate for mechanically scanning for wave signals in the azimuth direction;

a plurality of radiation elements positioned on said rotating plate for electronically scanning for wave signals in elevation, said radiation elements forming respective element signals;

coding circuitry coupling a respective code to a respective one of the element signals to form respective coded element signals;

a multiplexer associated with said plurality of radiation elements for consolidating the coded element signals received at each of said plurality of radiation elements to an analog bit stream;

an analog to digital converter for converting said analog bit stream to a digital bit stream;

circuitry for forming multiple digital beams corresponding to respective coded element signals from said digital bit stream; and

a digital receiver determining signal strengths for the coded element signals and locking onto a strongest signal having a corresponding element, so that the corresponding element can be used for transmission.

2. The antenna of claim 1, wherein said plurality of radiation elements are a plurality of parallel cross-slotted waveguides.

3. The antenna of claim 2, wherein each of said plurality of parallel cross-slotted waveguides includes a slotted septum therein.

4. The antenna of claim 1, wherein said circuitry for forming multiple digital beams does so through FFT techniques.

5. The antenna of claim 1, wherein said antenna may be utilized on a mobile vehicle.

7. An antenna for communication with an equatorial satellite constellation, comprising:

a rotating plate for mechanically scanning for a wavefront of wave signals in an azimuth direction;

a plurality of radiation elements positioned on said rotating plate for receiving the wave signals and generating respective element signals in response thereto;

coding circuitry coupling a respective code to a respective one of the element signals to form respective coded element signals;

apparatus for positioning said radiation elements such that the wavefront will be in alignment with a major axis of said plurality of radiation elements;

a multiplexer device being in communication with each of said plurality of radiation elements for converting said plurality of coded element signals into an analog bit stream;

an analog to digital converter for converting said analog bit stream to a digital bit stream;

a device for forming multiple digital beams from said digital bit stream; and

a digital receiver for processing said multiple digital beams to determine a corresponding element with a strongest signal strength, so that the corresponding element can be used for transmission;

wherein the antenna is able to lock onto a second equatorial satellite in the constellation before handing over from a first equatorial satellite.

8. The antenna of claim 7, wherein said device for forming multiple digital beam forms utilizes a FFT technique to provide for retrodirectivity.

9. The antenna of claim 7, wherein said antenna transmits said multiple digital beams to a plurality of satellites in the equatorial satellite constellation.

10. The antenna of claim 8, wherein said plurality of radiation elements are a plurality of interdigitally spaced slotted wave guides.

11. The antenna of claim 7, wherein said rotating plate is generally circular in shape.

12. The antenna of claim 11, wherein each of said plurality of interdigitally spaced slotted waveguides includes a slotted septum therein.

13. A method for forming multiple beams at a satellite antenna comprising:

providing a plurality of radiation elements on a surface of said satellite antenna for receiving a plurality of individual wave signals and forming respective element signals;

rotating said plurality of radiation elements such that a wavefront of said plurality of individual wave signals is in alignment with a major axis of said plurality of radiation elements;

coding the respective element signals to form coded element signals;

consolidating said plurality of coded element signals into an analog signal;

forming multiple beams from said analog signal;

determining signal strengths for the coded element signals and determining a strongest signal of the signal strengths and a corresponding element, and

transmitting a transmit beam using the corresponding element.

14. The method of claim 13, further comprising:

converting said single analog signal to a digital bit stream; and

forming multiple digital beams from said digital bit stream.

15. The method of claim 14, further comprising:

utilizing FFT techniques to form said multiple digital beams to provide for satellite retrodirectivity.

16. The method of claim 14, further comprising:

processing said multiple digital beams prior to transmitting.

17. The method of claim 14, wherein said plurality of radiation elements electronically scan for said wave signals in elevation.

18. The method of claim 17, wherein said surface of said antenna is comprised of a generally circular plate that rotates for scanning mechanically for said wave signals in azimuth.

19. The method of claim 18, wherein said plurality of radiation elements are a plurality of cross-slotted waveguides.

20. The method of claim 19, wherein said plurality of cross-slotted waveguides are parallel and interdigitally spaced with respect to each other.

21. A phased array antenna for communication with an equatorial satellite constellation, comprising:

a rotating plate for electronically scanning for a wavefront of wave signals in elevation and for mechanically scanning for said wavefront of wave signals in an azimuth direction;

a plurality of elongated radiation elements positioned on said rotating plate for receiving the wave signals and generating elements signals in response to the wave signals, each of said plurality of radiation elements having a major axis and a minor axis;

apparatus associated with said plurality of radiation elements for coding the elements signals according to location to form coded elements signals and consolidating the coded element signals received at each of said plurality of radiation elements into a first bit stream;

a multiple beam former for forming multiple beams from said first bit stream; and

a receiver for determining a corresponding element with a strongest signal strength, so that the corresponding element can be used for transmission.

22. The antenna of claim 21, further comprising:

a converter for converting said first bit stream from an analog bit stream to a digital bit stream, which digital bit stream is received by said multiple beam former.

23. The antenna of claim 21, wherein each of said plurality of elongated radiation elements are cross-slotted waveguides, which are aligned parallel to one another on the antenna.

24. The antenna of claim 23, wherein each of said plurality of radiation elements includes a slotted septum therein.

25. The antenna of claim 21, wherein the antenna may be utilized on a mobile vehicle.

26. The antenna of Claim 21, wherein said apparatus for coding and consolidating the wave signals comprises a multiplexer.

27. The antenna of claim 26, wherein said multiplexer is a code division multiplexer.

28. The antenna of claim 21, wherein the antenna is configured with a low profile.

29. The antenna of claim 21, wherein the antenna is in communication with a commercial satellite terminal.

30. A method of communicating with an equatorial satellite constellation, comprising:

providing a plurality of generally parallel waveguide elements on a surface of a satellite antenna;

rotating said satellite antenna such that a wavefront of a wave signal is in alignment with a major axis of said plurality of waveguide elements;

forming a plurality electrical waveguide signals;

consolidating said plurality of electrical waveguide signals into a digital bit stream;

forming multiple beams from said bit stream;

determining a strongest beam and corresponding waveguide;

transmitting a transmit beam to a satellite in the equatorial satellite constellation using the corresponding waveguide.

31. The method of claim 30, further comprising:

mechanically scanning a field of view for said wave signals in azimuth.

32. The method of claim 31, further comprising:

electronically scanning said field of view for said wave signals in elevation.

33. The method of Claim 30, further comprising:

forming multiple digital beam forms from said digital bit stream.

34. The method of claim 33, further comprising:

utilizing FFT techniques to form said multiple digital beam forms to provide for satellite retrodirectivity.

35. The method of claim 31, further comprising:

providing seamless handover from one satellite to another without interruption.

36. The method of Claim 31, further comprising:

monitoring signal strength from an adjacent wave signal in order to track other satellites in the equatorial satellite constellation.

37. A satellite terminal for communication with an equatorial satellite constellation comprising:

an antenna including,

a one-dimensionally rotating plate for mechanically scanning for wave signals in the azimuth direction;

a plurality of elongated waveguide elements having a predetermined location positioned generally parallel to one another on said plate for electronically scanning for wave signals in elevation, said waveguide forming an electrical waveguide signal in response to the wave signals;

coding circuitry coupling a respective code to a respective element signal to form respective coded waveguide signals;

a multiplexer associated with said plurality of waveguides for consolidating the waveguide signals received at each of said plurality of waveguides to a first bit stream;

a multiple beam former for forming multiple beams from said first bit stream;

a receiver for determining a strongest waveguide signal strength from a corresponding waveguide, so that the corresponding waveguide can be used for transmission.